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A Survey of Process Hygiene in the Sri Lankan Prawn Industry

III. Critical Control Points

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Introduction

Inherent in the line-system of producing processed foods are specific critical points ; for example, a processing phase which raises the temperature to a level which is conducive to rapid bacterial growth ; or which has some possibility of cross contamination between raw food and processed food.

In the processing of prawns in Sri Lanka the critical points centre around the temperature/time factor, allied to which is the contamination of processed prawns by the hands of personnel. Both critical points become more acute in tropical, as opposed to temperate countries, due firstly, to the higher ambient temperatures all year round in the tropics and, secondly, to labour-intensive processing regimes which are often replaced, in temperate countries, by peeling and grading machinery.

To identify critical points in the Sri Lanka prawn industry, the processing regimes of some fifteen export companies were monitored ; temperature readings of prawns in process were made, and the possibility of cross contamination assessed.

Materials and Methods

Temperature measurements were carried out using a "Technotherm Instant Action" meter (Testoterm K. G.) with a thermister probe. The temperatures of prawns at various stages of processing were measured—usually at least six temperatures being taken for each batch of prawns—and the data expressed as the range of temperatures.

Results and Discussion

Temperature data for the processing of raw (uncooked) prawns is presented in Table 1, and for cooked prawns in Table 2.

Ideally, the temperature of prawns in process should remain close to O°C. In practice, however, providing the temperature is maintained below 10°C, the process is considered to be in control. Below 10°C the generation time of the spoilage microflora means that bacterial replication will not reach unacceptable levels. As well, since the minimum growth temperature for *salmonellae* and *staphylococci* is 7–8°C, a process maintained below 10°C will prevent the replication of bacteria of public health importance. On this basis it was judged that the process if it was maintained below 10°C, could be considered "adequate" ; a processing phase which saw prawns temperatures elevated above 10°C was judged "inadequate".

In the present study five companies processing raw (uncooked) prawns were found to have a controlled process, while seven companies were found to have an inadequately controlled process (Table 1). All three companies producing a cooked product were found to have inadequate control of temperature during processing (Table 2).

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There were several factors common to all the companies which allowed prawn temperatures to rise above 10°C during processing. Firstly, during all washing phases the temperature of prawns will rise to the temperature of the mains water supply (28–30°C). After each washing phase, therefore, effective chilling is required.

Secondly, some companies practised an ineffective icing technique by placing large (*ca* 5–10 cm. diameter) blocks of ice on the prawns.

Thirdly, management of some processes allowed the build-up of prawns at certain stages, *e.g.* graded, washed prawns awaiting deheading, and at a temperature of 20–30°C.

In Tables 3 and 4 respectively, are presented a summary of critical points in the process, together with means of control of raw (uncooked) prawns and of cooked, peeled prawns.

Major critical control points centre around effective temperature control of the product, achieved by icing prawns correctly—surrounding thin layers of prawns (3–5 cm. thick) with layers of ice. It was noted that, in Company No. 3, which otherwise had a well-controlled process, there was a phase where cooked prawns were stored overnight in a layer some 10–15 cm. deep and covered by only a thin layer of ice ; as indicated in Table 2, after some 12 hours storage the temperature was still above 20° C.

In terms of cross-contamination of the final product a number of companies had premises which were ill-designed for the processing of a food product. In some cases processing was on two levels and prawns were carried upstairs by hand—ensuring a mixing of personnel between " dirty " (reception/grading) areas and " clean " (processing/packing) areas.

In other cases, finished product passed backwards through processing areas to the freezer—a practice which introduces considerable risk to the process. A " straight-line " process is much safer than a " U-shaped " or " S-shaped " process—a fact amply illustrated by the 1978 outbreak of botulism in UK from salmon canned in USA. The process-line in the Alaskan cannery was " U-shaped " with finished cans passing close to unprocessed cans.

Another means of cross contamination is equipment, and there appeared ample scope for equipment to pass from " dirty " areas into use in " clean " areas.

Overall, temperature control in the industry was found to be inadequate, with only a few companies using ice in sufficient quantities and correct distribution to ensure adequate control.

SUMMARY

Of fifteen processing plants surveyed, only five were found to have a prawn process which was adequately controlled. Most common process faults were : inadequate chilling of prawns after a wash in 30° C. mains water, the use of large blocks of ice to cool prawns, and high ratios of prawns to ice. There was also ample scope for cross-contamination of the processed prawns.

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TABLE 1

TEMPERATURE CONTROL IN THE PROCESSING OF RAW (UNCOOKED) PRAWNS

Company No.	*Raw Material*	*Graded Prawns*	*After Deheading*	*At Packing Stage*	*Assessment of Temperature Control*
4	1–5°	—	7–9°	0–12°	Adequate
5	0–3°	3–5°	2–5°	2–5°	Adequate
6	0–7°	17–19°	5–15°	5–15°	Inadequate
7	0–5°	9–16°	0–21°	0–21°	Inadequate
8	0–12°	2–12°	14–20°	3–17°	Inadequate
9	5–10°	3–11°	8–17°	11–16°	Inadequate
10	0–7°	2–7°	1–7°	0–10°	Adequate
11	0–7°	5–10°	5–10°	5–10°	Adequate
12	—	10–13°	8–21°	3–13°	Inadequate
13	1–3°	19–22°	0–13°	1–10°	Inadequate
14	0–5°	—	4–18°	25–27°	Inadequate
15	0–7°	2–10°	1–7°	—	Adequate

TABLE 2

TEMPERATURE CONTROL IN THE PROCESSING OF COOKED PRAWNS

Com-Pany No.	*Raw Material*	*Graded Prawns*	*After Deheading*	*After Cooking*	*After Peeling*	*At Packing Stage*	*Assessment of Temperature Control*
1	1–2°	5–11°	3–11°	—	—	11–24°	Inadequate
2	1–8°	5–17°	—	11–26°	7–23°	19–24°	Inadequate
3	1– 5°	1–5°	—	—	20–23°	—	Inadequate

TABLE 3

CONTROL OF CRITICAL POINTS IN THE PROCESSING OF RAW (UNCOOKED) PRAWNS

Process Stage	*Critical Point*	*Means of Control*
1. Grading	Washing raises temp. to 30° C.Large quantities of graded prawns present in factory	Effective icing—prawn : ice ratio 1 : 1 ; Management needed to smooth flow-pattern
2. Deheading	Spillage of gut contents and contents of thorax on butt meat of tail	Adequate washing in running water
3. Washing	Raises temperature of prawns to 30°C.	Effective icing
4. Peeling	Contamination of prawns with *Staph. aureus* from fingers of handlers	Good personal hygiene of process workers. Maintain prawns below 10° C. during Stage 4.
5. Washing	As for Stage 3	As for Stage 3
6. Deveining	As for Stage 4	As for Stage 4
7. Washing	As for Stage 3	As for Stage 3
8. Grading for packing	As for Stage 4	As for Stage 4
9. Packing	As for Stage 4	As for Stage 4
10. Storage prior to freezing	Storage introduces time factor of some hours until plate freezer is filled	Effective icing of cooled product.

TABLE 4

CONTROL OF CRITICAL POINTS IN THE PROCESSING OF COOKED, PEELED PRAWNS

	Process Stage	*Critical Point*	*Means of Control*
1.	Cooking	Raises temperature to above 70° C. Reduces bacterial loading	Adequate timing of length of cook
2.	Cooling	Growth phase of bacteria is between 10–45°C. ..	Rapid cooling essential. Cool from 70°–30° C in running water. Cool from 30°-10° C. either by immersion and agitation in ice/water bath or by effective icing
3.	Peeling	Contamination of cooked prawn from fingers of handlers. Growth of *Staph. aureus* enhanced due to reduced competition—micro–flora depleted during cooking	Good personal hygiene of workers. Maintain temperature of peeled prawns below 10° C.
4.	Washing	Raises temperature of prawns to 30° C. ..	Effective icing
5.	Packing	As for Stage 4	As for Stage 4
6.	Storage prior to freezing ..	Time factor vital	Short time required, together with effective icing of cooled product